



## **PART THREE**

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# **COMPETITIVE SOURCING STRATEGIES**

## Outline



### *PART ONE: Basis of Study*

- An Overview of Task Force Activities
- The Market and Liability Environment for Shuttle Operations

### *PART TWO: Evaluating the Shuttle Program*

- Shuttle Safety and the Prospects for Competitive Sourcing
- A Full Cost View of the Space Shuttle Program
- Shuttle Operations in a Competitive Sourcing Environment
- Policy and Legal Issues

### **PART THREE: Competitive Source Strategies**

- **Options for Competitive Sources**
- Competitive Factors

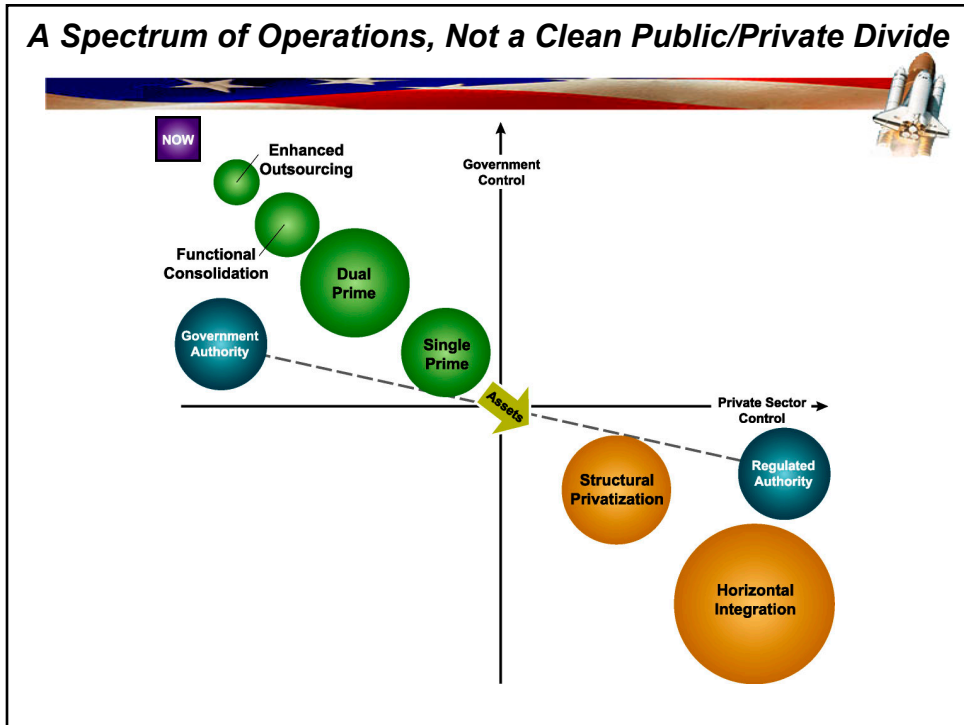
### *PART FOUR: Conclusions and Recommendations*

- Conclusions
- Recommendations

## OPTIONS FOR COMPETITIVE SOURCES

The Task Force identified seven options for increased outsourcing of Shuttle functions. This section describes each option and weighs its strengths and weaknesses.








The options can be placed functionally relative to government versus private-sector control. While not to be confused as a continuum of choices, the relative sizes of the choices represent the Task Force view of the relative complexities and difficulties of implementation. In addition, the choices are not meant to be mutually exclusive. Some options in which government control is maintained can be part of an evolutionary path to private-sector-oriented choices in which program assets may be eventually transferred.



The options identified by the Task Force break down into three classes. The first class contains four options representing various methods of revising the contractual architecture of the Shuttle program. The second class contains two options that can be considered privatization in that assets are transferred to a private firm. The final class contains a single option that involves the formation of an authority separate from NASA to operate the Shuttle with a mixture of government and contractor personnel.

## The Task Force Proposes Seven Options



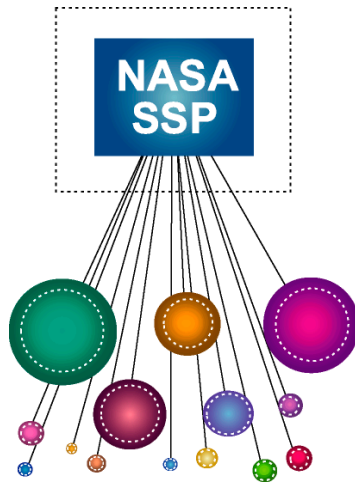
Option		Description
	Enhanced Outsourcing	Continuous and incremental transfer of government functions to private sector
	Functional Consolidation	Vertical alignment of contract functions around key functional support areas
	Dual Prime	Separates vehicle and system development from operations and logistics
	Single Prime	Single source contract for system operation
	Space Authority	A model designed for a non-competitive supplier base that creates a corporate instrument to operate the Shuttle
	Structural Privatization	NASA exits the operations arena as assets are transferred to the private sector under long-term lease
	Horizontal Integration	A structure designed to mimic airport operations

The Task Force examined seven competitive sourcing options that can be evaluated by NASA and the space policy community. At the outset of the Task Force's activities, specific guidance was given by NASA and OSTP not to recommend any of the options but only to assess the strengths and weaknesses of the various options without bias.

The Task Force realizes that it will be challenging to reduce this set of options to one or two that can be analyzed in greater detail. Selection will require a set of criteria with which to compare the strengths and weaknesses of the various options. The Task Force developed a set of 12 criteria (cited earlier in Part One) to help guide deliberations.

Each option is described below.

## ***“Enhanced Outsourcing” Exploits Existing Structure***



- **Attributes:**
  - No substantive structural change
  - Can be started immediately as evolutionary outsourcing
  - Continuous and incremental transfer of government functions
  - Could allow SFOC consolidation as currently planned
  - Uses current structure to drive toward efficiencies
  - NASA would retain control

The first option is called “Enhanced Outsourcing.” This option represents very little change to the existing organization of the contractors or their relationship to NASA. In this option, NASA would endeavor to transfer additional responsibilities and functions to the private sector. As stated earlier, the Shuttle program is already heavily outsourced. In this option, the outsourcing effort would grow further to include, for the first time, the private-sector sharing in the CoFR. This option, as well as others implies the consistent shrinkage of the SSP, in terms of overall staffing levels, as additional work is shifted to the contractor base.

## Strengths and Weaknesses of “Enhanced Outsourcing”



Strengths	Weaknesses
<ul style="list-style-type: none"> <li>• Relatively incremental; interim step toward full range of other options</li> <li>• Generally reversible (though not without cost) in whole or in part</li> <li>• Potential for additional competition in practice</li> <li>• Does not require fundamental restructuring</li> </ul>	<ul style="list-style-type: none"> <li>• No clean break from status quo</li> <li>• Scope for only limited, gradual refocusing and cultural change</li> <li>• Permanently high transaction costs (including senior management attention) arising from large number of contracts</li> <li>• Actual (not just potential) competition not guaranteed and for some functions likely to remain minimal or nonexistent</li> <li>• Fails to force NASA to make disciplined choices about scale and structure of SSP</li> </ul>

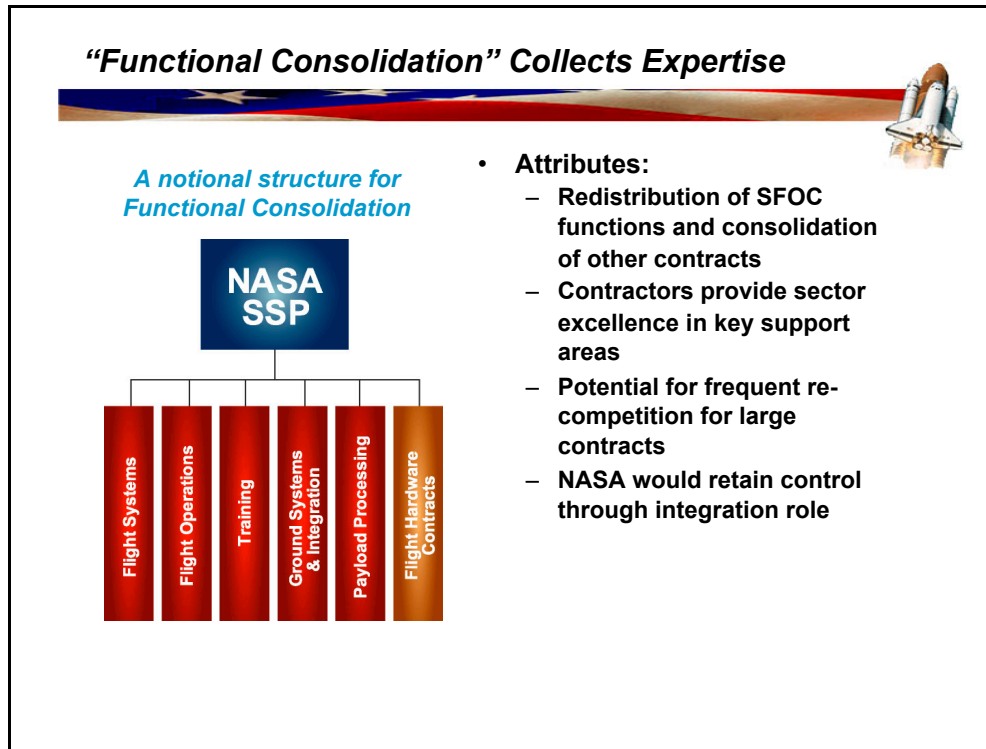
### *Strengths:*

Enhanced Outsourcing would essentially intensify current practice—seeking additional opportunities to expand the “make-versus-buy” boundary for the Shuttle program. An incremental increase in outsourcing and corresponding reduction in direct NASA production can be an interim step toward most (though not all) of the other strategic options. “Enhanced” refers not just to more outsourcing, but also to a more strategic stance toward outsourcing, and in particular a more disciplined effort to identify or foster competition among suppliers. The Administration’s competitive sourcing theme supports an intensified drive to gain the benefits of competition.

While enhanced outsourcing calls for changes in orientation and some additional training and analytic capacity, it does not require fundamental restructuring and thus is less politically and managerially demanding than the other options. It is also easier to reverse than the other options if disappointing experience or altered priorities warrant.

*Weaknesses:*

This is change on the margins, rather than a sharp break with the status quo, and thus offers quite limited potential for cultural transformation; NASA is still operating the Shuttle through a network of contractors. Even this limited potential will be realized only incrementally as the make-versus-buy boundary gradually shifts. The number of separate contracts under this option is likely to match the current total, so that the SSP will continue to bear the financial and managerial costs of organizing and overseeing its extensive contract network. Moreover, intensified competition is a goal, not a given. It will require a sustained and focused campaign on NASA's part to impose more competitive discipline on its supplier community. If this effort is not made—or if it *is* made, but fails in its intention—most of the benefits from enhanced outsourcing evaporate. Finally, this option lets hard choices about the scale and structure of the SSP be deferred or dodged—arguably a short-term strength, but from a broader perspective among the most objectionable features of Enhanced Outsourcing.



The next option is called Functional Consolidation. This option involves the decomposition of the SFOC contract into constituent elements. The primary goal in presenting this option is to create smaller, more numerous contracts than the current SFOC contract while still reducing the total number of contracts relative to the Enhanced Outsourcing option. Creating more contracts for the SFOC functions, theoretically smaller in size and scope, and more focused along centers of commercial expertise, reduces the barrier to entry for competing firms. In the chart, the Flight Hardware Contracts are shown in contrast to the other contract areas since these represent mostly sole-source relationships.<sup>1</sup> The Functional Consolidation option might require some moderate amount of growth in the number of NASA employees involved in the Shuttle program since integration workloads would most likely increase.

<sup>1</sup>The figure above implies that several propulsion contracts (ET, RSRM, and SSME) are consolidated. This would result in a contract of a magnitude similar in size to the current SFOC.

## Strengths and Weaknesses of “Functional Consolidation”



Strengths	Weaknesses
<ul style="list-style-type: none"> <li>• Relative to Enhanced Outsourcing: <ul style="list-style-type: none"> <li>- sharper departure from business-as-usual</li> <li>- lower transactions costs by reducing number of contracts managed</li> <li>- greater potential for NASA focus on system integration vice operation</li> <li>- better opportunities for efficiencies and innovation within functional areas of specialization</li> </ul> </li> <li>• Requirement to identify critical functional areas provides opportunities for clearer definition of Shuttle enterprise within NASA</li> </ul>	<ul style="list-style-type: none"> <li>• This could be viewed as a retrograde decision back to the past</li> <li>• Likelihood of absent or feeble competition in many functional areas, which would erode most of this options strengths</li> <li>• Requirement for strong contractual or oversight mechanisms to orchestrate cooperation across functions to avoid costly coordination failure</li> <li>• Continued integration/coordination role for NASA limits transformation potential</li> <li>• Limited structural incentives to stabilize design or standardize processes</li> </ul>

### Strengths:

This option is comparable to Enhanced Outsourcing. However, its major dimension of reform concerns the structure rather than the degree of contracting, so many of its strengths are most clearly depicted *relative* to Enhanced Outsourcing. Functional Consolidation departs more sharply from current practice, and thus is more conducive to cultural change. By paring the number of individual contracts, it reduces transaction costs (including, importantly, the managerial time devoted to contract-management issues). By integrating within the span of functional contracts operational responsibilities that are currently segregated—and so long as contracts are structured appropriately—it offers superior incentives and opportunities for efficiency improvements and innovation on contractors' part. Under Functional Consolidation NASA retains an operational role, but that role is clearly defined as system integration as distinct from detailed operations management—again, an enabler of cultural change. Finally, the process of defining the “blocks” of responsibilities by which functional contracts should be organized invites—and even forces—disciplined examination of the dividing line between Shuttle and the rest of NASA.

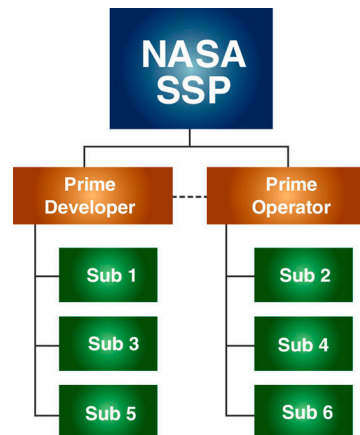
*Weaknesses:*

The first weakness is essentially a political vulnerability: Since SSP contracts were structured by function prior to SFOC, this could be portrayed as a retrograde movement rather than progressive management reform. More serious, perhaps, is the substantial risk that competition would turn out to be feeble or entirely absent within one or more key functional areas, which would rob this reform of its economic (though not, to the same degree, of its managerial) rationale. Since grave consequences could flow from a failure to coordinate the separate functions, NASA would have to build and maintain a robust “summit integration” capacity. This continuing integration and coordination role is different from existing contract-management duties, but sufficiently burdensome that the SSP would remain a major drain on management attention, constraining cultural transformation. Finally, Functional Consolidation features weak incentives on NASA's part, and weak or even perverse incentives on the part of contractors, to stabilize design and standardize procedures. Without clear-cut “ownership” of systemwide operational efficiency, this goal is likely to get short shrift.

## The “Dual Prime” Model Separates Two Key Functions



### A notional Dual Prime structure



- **Attributes:**
  - Separates vehicle and system development from operations and logistics
  - Akin to “aircraft builder” and “airline operator” strategy
  - NASA retains integration responsibility and decides how much is passed to primes
  - Reduced NASA procurement interface

A third restructured form is the Dual Prime option. Maintaining two prime contracts is intended to separate the task of developing hardware from the task of operating it. The relationship is an analog to an airline operator and aircraft manufacturer. The integration function could be designed to remain in the hands of the two prime firms, or NASA could continue to serve as system integrator. Since the procurement of hardware would pass to the prime developer, NASA’s transaction costs should be reduced under this option.

## Strengths and Weaknesses of a “Dual Prime”



Strengths	Weaknesses
<ul style="list-style-type: none"> <li>• Invites clearer definition of Shuttle enterprise within NASA as compared with status quo</li> <li>• Narrowing of contractor interface may permit NASA managerial efficiencies</li> <li>• If contractors share integration role, may facilitate cultural transformation within NASA</li> <li>• Dividing prime function means more scope for competition than with single-prime option (assuming more firms are able to fill one function than both)</li> <li>• Current industry major players will be supportive of this option</li> </ul>	<ul style="list-style-type: none"> <li>• High risk that one or both prime contracts will receive few initial bids</li> <li>• Managing disputes and ensuring coordination between the two prime contractors remains a major NASA managerial burden</li> <li>• Primes will be more inclined to remain with existing STS platform</li> <li>• NASA in weak position to maintain contract discipline</li> <li>• Very hard to unwind if the model fails to work</li> </ul>

### *Strengths:*

The process of structuring a dual-prime Shuttle architecture invites or requires a clearer definition of the SSP enterprise within NASA. Narrowing the supplier interface to a pair of prime contractors—rather than the current broad array of contracts, or even a set of functionally-consolidated contracts—could lighten the managerial load of running the Shuttle. To the extent the contract architecture anchors integration responsibilities on the two primes and lets NASA step away from operations, it clears the way for cultural transformation. This option, in its most likely manifestation, poses little or no threat to current major contractors, and thus is likely to be relatively easy to implement on both the political and administrative fronts. In an alternative version—deliberately designed to open one or both of the prime contracts to bids by firms not currently central to the SSP—the Dual Prime option could be more consistent with true competitive sourcing than many others. (Note, though, that either this advantage or the prior one can apply, depending on details of design and implementation—but not both. Intensified competition implies political heavy lifting.)

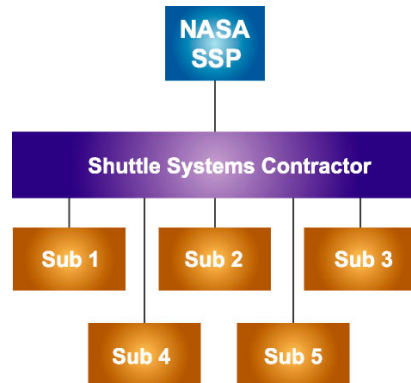
*Weaknesses:*

While in theory this option permits a significant degree of competition, in practice there is likely to be a small number of serious bids for each prime contract, with the potential of a single dominant supplier for each role. In the absence of more competition than seems plausible, NASA will have few realistic alternatives to incumbent prime contractors, and thus will be in a weak position to maintain contract discipline. Unless the contractual structure distributes coordination duties between the primes—which would be a challenging task of transactional architecture—NASA will retain substantial integration responsibilities. It would also need to broker disputes between the primes where joint operation introduces ambiguous responsibility for costs, schedules, or anomalies. Thus the SSP would remain a major management burden. Both primes are likely to find it commercially advantageous to stretch out the existing STS platform for as long as possible, creating a conflict of interest if either or both firms would otherwise play a significant next-generation role. Finally, for a range of technical, managerial, and political reasons, the Dual Prime model would be difficult to unwind if unanticipated problems arose in the course of implementation, or if anticipated problems turned out to be at the more severe end of the predicted range.

## A “Single Prime” Would Simplify NASA Interfaces



### A notional Single Prime structure



### • Attributes:

- Single contract for management and operational integration
- Very small NASA SSP
- Minimizes contractual interface
- Akin to DOE model for operation of R&D labs (LANL, Sandia, etc.)
- Possible that Shuttle Systems Contractor (SSC) contractor would not be current manufacturer or operator (heavily dependent on the term of the contract and ability to retain profit)

The final restructuring option is the creation of a Single Prime contract. As previously mentioned, this was the intended progression of SFOC, SSP's largest single contract (approximately 47 percent of program extramural spending).<sup>2</sup> A single prime contractor would present one central interface to NASA. Although it is not an essential feature of a single prime, it is likely that the procurement of Shuttle flight hardware, a complex and labor-intensive job at NASA, would become a contractor responsibility. A single prime contractor also presents NASA with a smaller coordination challenge, since the integration role would largely transfer to the contractor. This could lead to a significant opportunity to accomplish cultural change at NASA.

<sup>2</sup>The evolution of SFOC to become the de facto single prime has not yet occurred due to NASA's unwillingness to allow the Phase II SFOC consolidation to occur. The primary reason for NASA's caution in this regard is the feeling that USA, the SFOC contractor, has not secured the senior managers and engineers to assure the leadership that a single prime must demonstrate.

## Strengths and Weaknesses of a “Single Prime”



Strengths	Weaknesses
<ul style="list-style-type: none"> <li>• Potential for significant cultural transformation</li> <li>• Minimizes contracts managed by NASA</li> <li>• Much smaller coordination challenge for NASA than dual-prime model</li> <li>• May be possible to define prime role in a way that permits several potential bidders in initial competition</li> <li>• The nature of the prime contract could attract non-traditional even non-aerospace companies</li> <li>• Invites clear definition of Shuttle enterprise within NASA, as with other options beyond status quo</li> <li>• Structural incentives for efficiencies and innovation on contractor's part</li> <li>• Relatively clear transition path to Structural Privatization and to Space Authority</li> </ul>	<ul style="list-style-type: none"> <li>• Risk that extensive initial competition will fail to materialize</li> <li>• Requires sophisticated contract design and management capacity on NASA's part</li> <li>• NASA could incur risk if non-traditional company wins the competition</li> <li>• Strong incentive for prime contractor to encourage change orders unless fixed price</li> <li>• Very difficult transition to options other than Privatization or Space Authority for life of SSP</li> <li>• Very difficult to write effective contract without prior "right-sizing"</li> <li>• Prime will be more inclined to remain with existing STS platform</li> </ul>

### Strengths:

By clearly fixing responsibility for SSP operations on a single outside entity, the Single Prime option would offer NASA significant scope for cultural transformation. The single-prime model tightens the contractor interface and clarifies contract management. In contrast to the dual-prime model, coordination and dispute resolution are likely to be relatively minor managerial burdens for NASA. As with several other options, moreover, the process of designing the contract structure can clarify the relationship between the SSP and the rest of NASA. Cleanly defined responsibility of Shuttle operations—contingent, to be sure, on careful contract design—permits structural incentives for innovation and efficiency on the part of the prime contractor. A single-prime arrangement offers a relatively straightforward transition path to either structural privatization or the space-authority options. Finally, if a “thin-prime” variant proves feasible—that is, if the prime contractor can be selected for management and operations-integration capacity, rather than relevant technical expertise—this option may permit a significant degree of competition (for at least the initial contract).

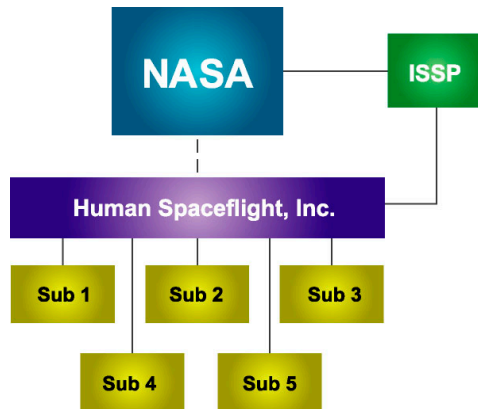
*Weaknesses:*

The thin-prime variant is likely to turn out to be unrealistic. The list of firms capable of managing a contractor network that includes major aerospace players may in fact include only major aerospace players; firms without relevant technical expertise may lack the requisite credibility and clout. In this event, the potential for lively first-round competition greatly narrows. If the thin-prime variant is judged to be worth a trial, experimenting with a nontraditional prime contractor would expose NASA to both technical and political risks. Even if there is a reasonable degree of first-round competition, the incumbent prime contractor is likely to become entrenched and resistant to rivalry in future rounds. The prime contractor will likely find it commercially advantageous to retain the current STS platform for as long as possible, discouraging its involvement in the development of a next-generation system. Managing the single prime calls for NASA to develop and maintain a sophisticated contract design and oversight capacity. It will be very difficult to write an effective prime contract—geared to price rather than cost, and built around clear-cut performance measures—without prior right-sizing, design stabilization, and a more detailed understanding of cost drivers than NASA now possesses. Absent a price-based contractual structure, the prime contractor will be well-positioned and highly motivated to encourage change orders. The transition path from the Single Prime model to any option other than structural privatization or the space authority, finally, would be hazardous.

## ***“Structural Privatization” Minimizes Government Role***



*A notional structure for Structural Privatization*



- **Attributes:**

- Assets are transferred to the private sector— NASA exits operations
- NASA plays regulatory role in Shuttle operations (but retains shared CoFR)
- NASA Space Shuttle Program disbanded— remaining roles transferred to the International Space Station Program (ISSP)
- NASA buys at service price, not cost

This option and the next are options for privatizing the Shuttle.

The first privatization option shown is called Structural Privatization. The firm selected to privatize the Shuttle would, in large part, assume the role of the current SSP. NASA would maintain a limited oversight of a “human spaceflight” company operating the Shuttle system and procuring flight equipment. Customers would contact the privatization firm directly for human space transportation services and pay the service price, and not the cost, of a ride to space.

## Strengths and Weaknesses of “Structural Privatization”



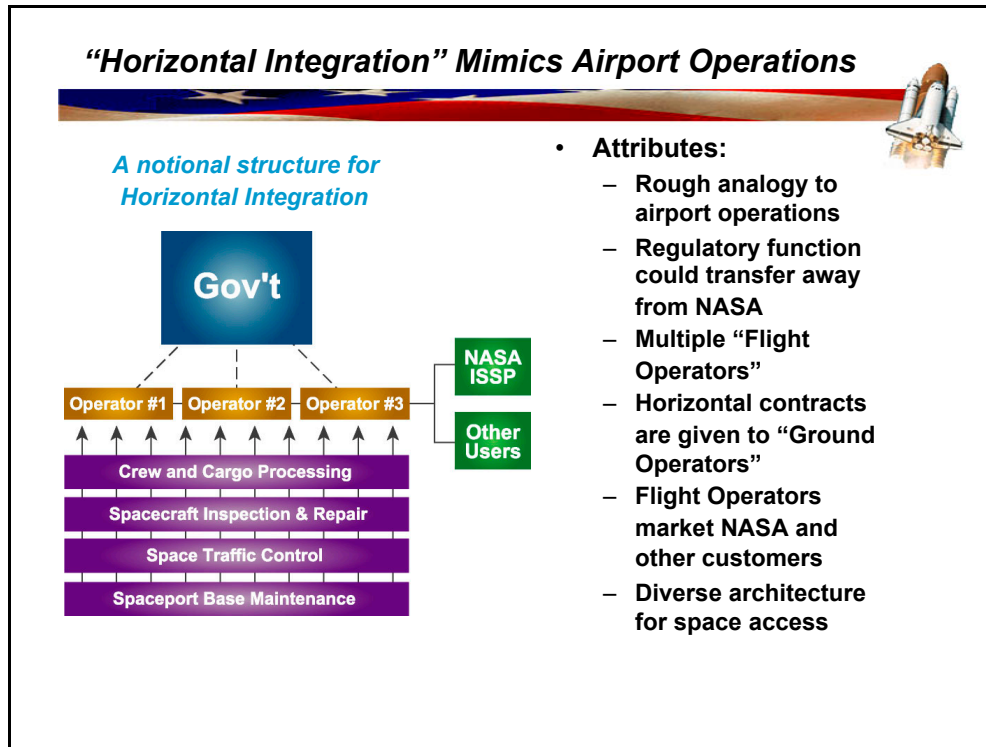
Strengths	Weaknesses
<ul style="list-style-type: none"> <li>• Maximum potential for cultural transformation within NASA</li> <li>• Allows NASA to exit the business of operating human space assets</li> <li>• Energizes search for commercial use of extra SSP capacity</li> <li>• Provides testing ground for preferred approach to next-generation STS, including development of market-driven safety consciousness through risk-based insurance rates</li> <li>• Very strong incentives for efficiency improvements and innovation on private operator's part</li> <li>• Potential to access credit markets</li> </ul>	<ul style="list-style-type: none"> <li>• No viable business case currently identified</li> <li>• Viability may require next generation vehicle</li> <li>• Efficiency gains will benefit private player, with little hope for savings to NASA</li> <li>• Risk-based insurance rates will not develop if NASA is seen as ready to shield its only source of human-rated launch services by absorbing losses below indemnity level</li> <li>• Potential for safety lapses in the absence of risk-based insurance rates, or robust ISAO, or both</li> <li>• Extremely difficult to unwind for life of SSP if model fails to work</li> <li>• Significant risk of conflict of interest if private supplier is involved in both SSP and next-generation STS</li> </ul>

### *Strengths:*

Structural privatization is the purest restructuring model on the table—NASA divests itself of the Shuttle and becomes simply a customer. As NASA exits from direct operation of human spaceflight assets, it liberates itself to reshape its culture—or more accurately, to restore its founding culture. Beyond the immediate benefits, Shuttle privatization would be a testing ground for a market-based approach for future generations of space transportation systems. In particular, it would accelerate the emergence of an insurance industry with the experience and sophistication to estimate variations in Shuttle risks and set rates accordingly. Risk-dependent insurance costs are central to market-driven safety consciousness in other hazardous industries. A private Shuttle owner could raise resources through the sale of equity, the issuance of debt, or infusions of funds from a parent or partner, and could undertake upgrades and infrastructure investments that NASA has deferred. It would have powerful incentives to innovate and improve operational efficiency, and to develop any latent source of commercial demand for surplus Shuttle program capacity. While the Task Force identified little commercial demand for Shuttle program services, we recognize that market opportunities often emerge unpredictably once firms are motivated to find them.

*Weaknesses:*

The defects of this option are as fundamental as its virtues. The current dearth of commercial demand for STS services means that NASA would be the sole customer in the short run, and the mainstay for an indefinite period, of a privatized Shuttle. In consequence, the transfer of STS assets would need to be on terms very generous to the private partner; there may be no takers except at a large negative "price." Another consequence is that NASA will be dependent on a self-created private monopoly for human spaceflight services. Thus any efficiency improvements will benefit only the private Shuttle operator, since it will have no incentive to pass savings on to NASA. The mutual dependence of a single buyer facing a single seller also suggests that a risk-based insurance market may fail to develop; NASA may be seen as willing to bail out its sole STS provider by absorbing losses beyond any formal indemnity. If so, the private operator will fail to fully insure up to the indemnity level; insurance will be a small part of its cost structure; and market motives for safety consciousness will be artificially weakened. The private Shuttle operator would also be motivated to stall any replacement of the Shuttle, introducing a major conflict if (as is likely) the Shuttle is transferred to a major aerospace firm. Finally, Structural Privatization would be extremely difficult to reverse if the model failed.



The second privatization option is called Horizontal Integration. This option is designed to roughly mimic airport operations and is built upon a foundation of nested contracts that support several vehicle operators. These operators could own one or two orbiters supplying services to the customer community. One operator, for example, could own *Endeavour* and *Atlantis* serving an ISS customer. Another operator could own *Columbia* and service NASA space science and potential other government agencies interested in flying technology demonstrator payloads. A third operator might own *Discovery* as well as be a service provider for Russian human space transportation assets. Operators could also combine human and cargo transportation services. The main feature of this option is diversity of services being supplied with operators supported by a stable base of horizontally integrated contractors. A decision by NASA to build future launch systems that operate with the Shuttle to provide alternate access to space is a natural fit for this option. This option is also resonant with a notion of operating the current launch complex at KSC as a regional municipal spaceport.

## Strengths and Weaknesses of “Horizontal Integration”



- Horizontal-Integration option shares the same strengths and weaknesses as the Structural-Privatization option, with the following additions

Strengths	Weaknesses
<ul style="list-style-type: none"> <li>• NASA one of many purchasers of human space flight service, therefore out of space transportation business</li> <li>• Greatest potential for market discipline and cost savings through competition among the separate operating companies</li> <li>• Good fit with the notion of developing alternate access to space architectures with many components (fleet mix)</li> </ul>	<ul style="list-style-type: none"> <li>• Even more dependent than Structural Privatization on emergence of major new markets</li> <li>• Need multiple viable business models, one for each operator</li> <li>• Likely requires 3rd generation vehicle</li> </ul>

Horizontal Integration, as a variant of full STS privatization, shares the strengths and weaknesses of Structural Privatization but has significant distinctive features as well.

### *Strengths:*

Structural Privatization describes a relatively primitive market-based STS; Horizontal Integration is more sophisticated. Instead of a vertically-integrated monopoly supplier of spaceflight services, a network of private firms cooperate—and compete—in response to market prices. NASA would be one among many purchasers of human spaceflight services. As other customers enforce market discipline, NASA could be less concerned with purchasing strategy. This option not only offers the greatest scope for cultural transformation, but also for innovation and cost savings generated by competition among the separate operating companies and by the cost-consciousness of private firms across the value-added chain. This option also encourages the evolution of a heterogeneous mix of technologies for space access.

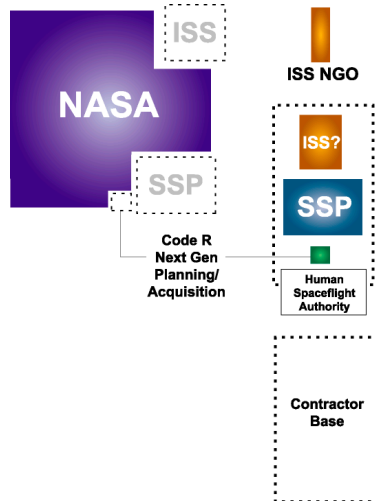
*Weaknesses:*

Just as Horizontal Integration is an even more desirable version of market-based space transport than Structural Privatization, it is also even less realistic. The emergence of significant commercial demand for STS capacity is desirable for Structural Privatization, but absolutely essential for Horizontal Integration. The implausibility of such demand developing in the short or medium term is a major obstacle confronting this option. Even if that objection could be overcome, Horizontal Integration has a subtler but equally fundamental weakness: It requires not just one realistic business model, but many. There must be a viable business plan for each operating company; for one or more cargo and crew processing concerns; for one or more spaceport management and maintenance companies; and so on. So Horizontal Integration is a worthy vision for the future of human space flight, but it is simply not available to us today.

## ***“Authority” Option Addresses Lack of Competition***



### ***A notional Human Spaceflight Authority model***



#### **Attributes:**

- Acknowledges lack of competition in the supplier base and creates corporate instrument to operate the Shuttle
- Projects that demand for human spaceflight services will be dominated by government for the foreseeable future
- Can incur debt (float bonds) to maintain, operate and modernize system
- Similarities to regional mass transit authority
- Authority assumes NASA assets

The Task Force examined a final option—the notional Human Spaceflight Authority option. An authority is a hybrid organizational structure that accomplishes many of the goals of competitive sourcing. Creating a Human Spaceflight Authority has two important aspects: (1) it establishes and builds upon a corporate instrument to organize the Shuttle program, and (2) it provides a means of raising debt capital in the form of bonds. Authorities are organizational structures that operate in situations characterized by limited commercial competition, or where prices must be carefully controlled. An authority typically serves the common good, being formed in circumstances where market forces alone will not yield the best solution.

Consideration of this option was prompted by the Task Force’s conclusion that the prospect of true competition of the Shuttle supplier base was limited. Further, it had become apparent that the “market” was limited primarily to the NASA-sponsored activity of constructing and servicing the ISS.

The rules governing the creation of an authority are broad based and range from government authorities to formulations that are essentially highly regulated private firms. They are most obviously seen in the form of regional transportation authorities, the entities that manage local bus, rail, and airport systems.

A space authority could be formed in many ways; the one shown in the figure would acquire the SSP as well as the operating component of the ISS program. Since it is presumed that the authority would procure follow-on launch systems, it would also acquire, from NASA's Office of Aerospace Technology, the groups responsible for developing requirements for next-generation systems.

Since an authority is often viewed as a pseudo-governmental institution, its creation might be construed as a step backward from the notion of competitive sourcing. A spaceflight authority does, however, provide a clear mechanism for changing NASA's culture. As shown in the chart, the authority would acquire the major portion of HEDS assets and personnel. Virtually all *operational* elements of HEDS would be aligned under the new authority, freeing NASA to focus on R&D. This includes freeing the human exploration community to plan future missions without the need for concern about human transportation to LEO.

The relationship between the authority and the existing contractor base need not change. The authority could choose to maintain the current SFOC contract in essentially its current form. The Task Force recognizes that forming a space authority would be a dramatic shift not only in NASA's culture, but in the political relationships between the SSP and the NASA field centers, as well as the existing relationships between NASA and its oversight offices. A spaceflight authority could also be viewed as a transitional form, since it would be relatively straightforward to privatize the entity should the market for Shuttle services take a different turn.

Another important aspect of a spaceflight authority is that NASA can begin the process of reorganizing along these lines now. By reformulating the management structures of the Space Shuttle and Space Station programs, NASA can begin to pull together the operational components of human spaceflight, under a single program, with the potential benefit of removing any existing redundancies by ending the current field center-dominated matrix management process.

## Strengths and Weaknesses of the “Authority” Option



Strengths	Weaknesses
<ul style="list-style-type: none"> <li>• Allows NASA to exit the business of operating human space assets</li> <li>• Forces clear delineation of Shuttle enterprise</li> </ul>	<ul style="list-style-type: none"> <li>• Depending on governance model, could be cast as a retreat from competitive sourcing</li> </ul>
<ul style="list-style-type: none"> <li>• Consistent with a wide range of governance models</li> </ul>	<ul style="list-style-type: none"> <li>• Depending on governance model, may provide lower potential for efficiency gains than other options</li> </ul>
<ul style="list-style-type: none"> <li>• Feasible without emergence of commercial market for Shuttle capacity</li> </ul>	<ul style="list-style-type: none"> <li>• Political and managerial determination required to move Space Authority toward more market discipline or eventual privatization</li> </ul>
<ul style="list-style-type: none"> <li>• Explicit strategic response to limited competition in supplier base</li> </ul>	<ul style="list-style-type: none"> <li>• Severe political resistance should be expected due to backlash from existing contractor base</li> </ul>
<ul style="list-style-type: none"> <li>• Possible interim step toward privatization</li> </ul>	
<ul style="list-style-type: none"> <li>• Provides smooth transition to next generation systems</li> </ul>	
<ul style="list-style-type: none"> <li>• May provide political flexibility in making “right sizing” decisions</li> </ul>	
<ul style="list-style-type: none"> <li>• Minimizes risks of cross-organizational coordination failure</li> </ul>	
<ul style="list-style-type: none"> <li>• Potential to access credit markets</li> </ul>	

### *Strengths:*

The Space Authority option is an effort to steer between two unattractive futures. One is for Shuttle operations to preoccupy NASA’s management indefinitely and distort its culture. The other is for NASA to increase its vulnerability to private suppliers facing weak market discipline. Shuttle operations remain public—at least in the short run—but are separated from NASA. This forces a clean delineation of the Shuttle enterprise, and allows NASA to return to its original R&D orientation. It does not require the emergence of commercial demand for Shuttle services, and it recognizes the weak market discipline within a supplier industry geared to a single public-sector purchaser. An authority devoted solely to space transportation would be in a better position to make rational make-versus-buy decisions; strategic supply-chain management would be its core competency, rather than a distraction from the primary mission as it is for NASA. With a predictable revenue stream, a space authority could access credit markets to raise capital for needed investments beyond annual appropriations. Finally, the authority structure is consistent with a range of governance models—including a G-Corp, or potentially an Employee Stock Ownership Plan (ESOP) as well as conventional civil service—and can evolve toward privatization as the maturation of markets permits.

*Weaknesses:*

Precisely because a space authority would be better positioned than NASA to enforce accountability on a supplier network facing weak market discipline it will face intense political objections. Opponents will likely cast the authority as a retreat, not an advance, for competitive sourcing. If the governance model is conventionally governmental, these charges may be credible. Beyond its political vulnerability, an authority would have weaker incentives for operational efficiency than a privatized SSP, though the right choice of governance model and an appropriately structured relationship with NASA could strengthen these incentives. There is a risk that the relationship with NASA could become either collusive or adversarial, rather than manifest the desirable healthy tension. It will be a challenge to structure the right degree of financial discretion—too little, and the authority will be unable to make needed investments; too much, and there will be a risk of the wasteful empire building displayed by some port authorities and similar organizations. Political and managerial determination will be required to move the authority progressively closer to privatization. Finally, the creation of the authority and the transition of STS responsibility from NASA will be a significant management challenge.

### **Common Themes Across Options**



- **Preserving high level of safety is paramount**
  - ISAO is key
- **All options offer potential for fixed-price Shuttle services**
  - Under fixed pricing, savings would accrue to private operator, not government
  - NASA must extract savings from restructuring before shift to fixed-price can be considered
  - Another important reason to pursue right-sizing now
- **Designing optimal implementation plan will take at least two years**

The options presented so far are structured to present NASA with a strategic choice. Each option represents a unique future, but there are some common themes. Most important of these common themes is the need to preserve safety. *It is important to note that the diagrams shown in the previous seven figures do not identify the ISAO mentioned earlier as being critical to the success of a competitive sourcing solution.* This is because all options should include this organizational structure as a link between the government and the operating contractor. The key to establishing the ISAO is not the competitive sourcing option that NASA selects; rather, it is the decision to share launch responsibility, authority, and liability that should trigger the creation of the ISAO.

Another common theme among competitive sourcing options is the potential for providing Shuttle services at a fixed price. It is hoped that once Space Station assembly is complete, Shuttle servicing will become more routine, an outcome supportive of fixed price operations. Under fixed pricing, savings accrue to the private operator as increased profits and not to the government. NASA must extract any significant savings due to restructuring of the Shuttle program before a shift to a fixed price footing can be considered to prevent the operating contractor from extracting windfall profits. This is another important reason for pursuing right-sizing. Fixed pricing could exacerbate safety concerns since the

private firm might be inclined to trim costs in the name of profitability. While the Task Force found that other cross-incentives would prevent such shortsightedness on the part of a private Shuttle operator, there are no guarantees and additional safeguards are warranted under a fixed price contract, particularly until an appropriately risk-sensitive insurance market develops. For this reason, the creation of an ISAO should precede a shift to fixed price.

Whatever competitive sourcing option NASA selects, it is likely that it will take some time to design optimal implementation plans. The steps required to put the options outlined above in place are many in number and complex in form. The Task Force estimates that it will take at least two years to initiate a competitive sourcing plan. As this plan is being formulated, however, NASA can simultaneously begin the process of right-sizing the program to meet expected levels of demands.

## Outline



### *PART ONE: Basis of Study*

- An Overview of Task Force Activities
- The Market and Liability Environment for Shuttle Operations

### *PART TWO: Evaluating the Shuttle Program*

- Shuttle Safety and the Prospects for Competitive Sourcing
- A Full Cost View of the Space Shuttle Program
- Shuttle Operations in a Competitive Sourcing Environment
- Policy and Legal Issues

### *PART THREE: Competitive Source Strategies*

- Options for Competitive Sources
- **Competitive Factors**

### *PART FOUR: Conclusions and Recommendations*

- Conclusions
- Recommendations

## COMPETITIVE FACTORS

This section examines competitiveness issues raised by the various sourcing options.

### ***Decision on SFOC Tied to Resolution of Many Factors***



- **Implementing some competitive source options will likely require breaking up SFOC; others *could* be built upon current SFOC structure:**
  - “Functional Consolidation” and “Horizontal Integration” options would require a restructuring of the SFOC contract
  - “Authority” option could absorb the SFOC structure
  - “Enhanced Outsourcing,” “Dual-Prime,” and “Structural Privatization” options could be built upon existing SFOC structure
  - “Single-Prime” option could be based on an evolution of SFOC, but would most likely require restructuring
- **Competitiveness issues also influence NASA’s decision on SFOC:**
  - Addressing NASA’s concern that the government is not best served by a monopoly provider
  - Broader goals to improve the competitive environment (valid only if NASA actions will assuredly lead to more competition)

*Plans for the SFOC contract should be based on the selection of a competitive sourcing strategy that meets NASA future needs and a realistic assessment of the current competitive environment*

The SFOC contract is the single largest contract in the Shuttle program, representing nearly 50 percent of extramural spending. SFOC currently covers over 10,000 employees, deployed to several NASA field centers (though heavily concentrated at KSC).

SFOC was designed as a consolidation initiative, to find cost and operational efficiencies and to streamline the NASA/contractor interface. SFOC was to proceed in two phases. The Phase I effort involved the initial consolidation of smaller contracts under a lead operational contract. Phase II would involve additional consolidation resulting in what would essentially be a single prime contractor managing the Shuttle. NASA did not allow the Phase II consolidation to occur and SFOC has not yet evolved to single-prime status. The consolidation effort to date has, however, captured the majority of contracts and functions under a single “operations” envelope.

The Enhanced Outsourcing, Dual Prime, and Structural Privatization options could use the structure of SFOC with minor modifications. The Single-Prime option could be based on an evolution of SFOC, but would most likely require restructuring. Other competitive sourcing options, however, would likely involve severe restructuring of SFOC. The Functional Consolidation and Horizontal Integration options represent a resorting of activities within the Shuttle program and would likely,

therefore, dissolve the SFOC contract. Under Functional Consolidation many of the elements of SFOC would be redistributed to create a set of functions aligned with specific areas of expertise. Horizontal Integration involves the same reformulation, although the distribution of functions varies.

The remaining option, a space authority, could be built either way. The Authority could choose to maintain a relationship with industry in which SFOC remains in much the same formulation. Alternately, a new authority could choose to either absorb the functions currently being conducted by contractors, or reformulate the contract in a vein similar to the Functional Consolidation or Single-Prime options described earlier.

NASA's most important decision is to first select a path for competitive sourcing and then to decide how to handle SFOC. There is well-placed concern within NASA that the government may not be best served by what is essentially a monopoly provider, a situation that will be further extended by a decision to expand the basis of SFOC. It is not clear, however, that the environment surrounding the Shuttle program is such that competition would be generated if competitive sourcing options were pursued that resulted in the dissolution of SFOC. It is essential that NASA ascertain the likely competitive outcome of the various courses of action available before making a key decision on the fate of SFOC.

## SSP's Competitive Environment Is Very Limited



- **Boeing and Lockheed Martin are the dominant players:**
  - Secure ~16% of *all* Federal procurement spending
  - Boeing/LMCO/USA represent 2/3 of SSP's contract spending
  - Other firms rely on strategic alliances with Boeing or LMCO (see note)
- **Shuttle program is a critical program only for USA and ATK/Thiokol**
- **Additional aerospace M&A actions might occur:**
  - Competitive environment will be different two years hence

Company	SSP Participant	Total Assets (\$B)	Gross Profit Margin	Debt/Equity	Sales Revenue			SSP Sales		Fortune 1000 Position	Backlog (\$B)	Earning per Share (Diluted)
					2002 Estimated	Gov't	Private	Value (\$M)	% Total Sales			
Boeing		46.2	18.6%	1.16	58.2	40%	60%	260	0.45%	12	110	-1.54
Lockheed Martin		27.8	9.6%	1.03	24.8	78%	22%	430	1.73%	77	71	0.49
TRW		14.5	18.5%	2.14	16.3	73%	27%	~ 0	-	122	9	0.71
Northrup Grumman		4.1	20.6%	0.69	13.6	87%	13%	~ 0	-	151	10.1	1.27
Raytheon		25.6	21.5%	0.55	16.8	71%	29%	50	0.30%	119	26.5	-1.07
United Technologies	Hamilton Sundstrand	27	31.8%	0.48	27	14%	86%	78	0.29%	59	n/a	0.92
Alliant Techsystems	Thiokol	2.2	26.8%	1.56	1.81	75%	25%	380	20.99%	-	n/a	0.68
United Space Alliance		n/a	n/a	n/a	1.5	100%	0%	1500	100.00%	-	n/a	-
SAIC		4.9	19.9%	n/a	6.1	88%	12%	21	0.34%	-	4.1	0.08
DynCorp		0.6	7.1%	n/a	1.96	98%	2%	20	1.02%	730	6.1	5.27

### NOTE:

- Northrop-Grumman teamed with LMCO on the Longbow program; leading sub to LMCO on JSF, and to Boeing on F-18
- Raytheon and LMCO JV on Javelin
- For Alliant Techsystems, both LMCO and Boeing contribute 10% each to private portion of sales

*Opportunities for enticing competition can only be realized with significant changes in procurement strategy*

Mergers and acquisitions within the aerospace industry increased dramatically during the 1990s, creating a dilemma for government procurement officials. On one hand, contraction of the aerospace industry, necessary to reduce overcapacity, has improved efficiency. On the other hand, the sharp reduction in the number of potential bidders has greatly constricted the competitive environment.<sup>3</sup>

Boeing and Lockheed Martin are by far the largest firms competing within the domain of the Shuttle program, though revenue from the Shuttle program is far from a dominant contributor to total sales. Both firms have a long history with NASA and the Shuttle program and are relied on for producing key hardware and components for the fleet. Equipment produced by both firms has performed well and the firms remain committed to the success of the program. It is fair to say that NASA needs these firms, and the other Shuttle contractors, to remain engaged in the program to ensure safety and performance.

Another factor is the set of strategic alliances among contractors. Generally an alliance between two firms will not prevent competition in

<sup>3</sup>Augustine, N., "Unhappy Birthday: America's Aerospace Industry at 100," *Aerospace America*, February 1997, p. 37.

another domain. The aerospace industry is experiencing a downturn in many sectors. Economic pressures can heighten concerns about stressing these alliances on large contract competitions.

The lack of a competitive environment surrounding the Shuttle is not surprising. As an older program, with contractors having initial developmental experience as well as 20 years of operations under their belts, the barrier to entry for a potential new firm is very high. With many sole-source contracts in place, the room for competition is extremely limited. If NASA chooses to emphasize a goal of increasing competition in selecting a competitive sourcing option it is possible that few, if any, new bidders will become involved in the Shuttle program.

## New Players Face a Stiff Entry Barrier



- Companies have a finite Bid and Proposal (B&P) budget:
  - Level is set by the prescribed G&A rate structure and revenue base
  - B&P budgets are set up well before a bid based on market knowledge and the state of competition
- Competitive sourcing will likely lead to significant restructuring—this *might* improve competition if:
  - Companies have time to prepare sufficient B&P budgets
  - NASA takes deliberate steps to engender competition

Bid/No-Bid Criteria	Example	Strategy to Attract Competition
Size of procurement (base value)	\$2B	Size procurement packages to reduce B&P requirements
B&P Investment Required	\$20-\$40M	
Base Term	4 years	Consider a longer base term
Fee Potential	5% = \$100M	Raise fee
Stability of Requirements	Low	Multiple industry workshops, clear ConOps, and performance-based requirements
Stability of Procurement Schedule	Moderate	
Time from RFP-to-Award	18 months	
Ability to Discriminate	Moderate	Publish evaluation criteria and WBS early - open books on resource allocations throughout program
Number of Competitors	2	
Competitor Strength	High	
Strength of Incumbent	High	
A-76 components?	Yes	Start early on preparation of a fair basis of comparison
Potential for A-76 protest	Moderate	

**NO BID**

A natural consequence of consolidation is the growth of a large, single, multipurpose contract against which it is difficult for firms to compete. The Lockheed Martin/Boeing joint venture with USA, the ultimate winner of the SFOC competition (a competition with only one bidder), created a powerful competitive force against which few firms can muster a viable proposal during a recompetition.

Bid and Proposal (B&P) budgets are built over time, usually to prepare for competitions that are several years away. Successfully competing in the Shuttle acquisition is likely to require large amounts of B&P funding. It takes time for a firm to build this “war chest” and there has to be a good chance of displacing a firm in order to place such large sums of money at risk.

NASA can take steps to reduce the B&P threshold and encourage firms to bid; the table above lists many of these steps. The Agency can work to ensure that it fully appreciates the many factors that go into a bid/no-bid decision on the part of private industry. NASA can also test various competitive sourcing options with a Request for Information to gauge industry reaction and likely bidding strategies prior to deciding how to proceed. In pursuing such a strategy, however, NASA must demonstrate clear intent to pursue open competition if private firms will be enticed to

respond, or for NASA to extract maximum responsiveness from the current SFOC contractor.

